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The Correspondence between the Vortical Prequantum Model of Baryon and the Constituent Quark Model, Related to Their Magnetic Moments

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Abstract

The paper shows the relative correspondence between the values of the baryons' magnetic moments obtained by a vortical pre-quantum model of baryon of a Cold genesis theory (CGT), in which the baryon's electric charge is given by embedded electron(s) with degenerate magnetic moment, and the Constituent quark model, in which the baryon's electric charge and its magnetic moment are given by the fractional charge and the magnetic moments of three constituent quarks having spinorial and orbital kinetic moments, the resulting correspondence being in accordance with the experimental observations regarding the beta-decay. For the known baryons resulting by (semi)light quarks, satisfactory values of magnetic moments were obtained. It was argued that the CGT's model of baryon can explain more naturally the fact that, in beta disintegrations, an electron with integer e-charge is emitted and not one with fractional charge and that it can also explain the P-parity violation experiment.

Keywords

Baryon Magnetic Moment, Constituent Quark Model, Vortical Nucleon, Dynamide Neutron Model

1. Introduction

The constituent quark model was built as a phenomenological model based on the symmetries of the naive quark model, initially considered for light quarks given by a cloud of gluons and unpaired current quarks ("sea" quarks) around of a valence current quark as kernel, which is considered to be an effect of the spontaneous breaking of the Chiral Symmetry of Quantum Chomodynamics. Modern constituent quark models mix one and two-hadron configurations, and are used to study more complex states such as tetraquark or pentaquark states, that are beyond the "naïve" quark model.

The successes of the constituent quark model in explaining regularities in experimental data that are not explained by other approaches, such as the effective quark mass difference $m_s - m_u$ between the strange and up quarks and their mass ratio m_s/m_u, and the baryons' magnetic moments [1].

The standard technique for measuring the baryons' magnetic moments is to produce a beam of polarized hyperons, precess the polarization vector in a strong magnetic field, and then determine the final spin direction that the hyperon maintains as it leaves the magnetic field region, by observing the asymmetry in the decay distributions of the detected decay hyperons, the magnetic moment being proportional to the angle of precession. These experiments give precise values for the magnetic moments of members of the baryon octet.

In the Constituent quark model, based on Quantum mechanics, the magnetic moment of a particle with electric charge e and mass m is equal to its g-factor (gyromagnetic factor, which has the value 2 for a particle's spin $s = \hbar/2$, conform to the Dirac equation (with $\hbar = h/2\pi$)) multiplied by $(e/2m)\vec{s}$. For mesons and baryons, the fact that $g > 1$ indicates that they have an internal sub-structure.

Within the quark model, the magnetic dipole moment of a baryon is obtained by computing the expectation value of the operator: $\vec{\mu}_i = g\left(q_{ie}/2m_i\right)\vec{s}_i$ on quark i with charge q_{ie}, constituent mass m_i, $g = 2$ for point-like fermions, and by adding the contributions of the three quarks.

For equal values of the constituent masses of the u- and d-quarks: $m_u = m_d \equiv m$, and a mass m_s of the s-quark, the magnetic moments of these quarks are then given by:

$$\mu_u = +\frac{2}{3}\left(\frac{e\hbar}{2m}\right); \quad \mu_u = -\frac{1}{3}\left(\frac{e\hbar}{2m}\right); \quad \mu_u = -\frac{1}{3}\left(\frac{e\hbar}{2m_s}\right) \tag{1}$$

The calculation assumes that the quarks behave like point-like Dirac particles, *i.e.* an expression similar to that for the nuclear magneton: $\mu_N = e\hbar/2m_p$, (m_p—the proton mass).

The magnetic dipole moment of the proton, obtained by adding the quark contributions, is:

$$\mu_p = \sum_{i=1}^{3}\left\langle p\uparrow 2\middle|\mu_i s_{zi}\middle|p\uparrow\right\rangle = \sum_{i=1}^{3}\left\langle p\uparrow\middle|\mu_i\sigma_{zi}\middle|p\uparrow\right\rangle \tag{2}$$

where $\left|p\uparrow\right\rangle$ is the wave function for a proton with spin along the z-axis, $\vec{s} \equiv \frac{1}{2}\vec{\sigma}$ and σ_i is the spin operator of the i-th quark.

By writing the wave function of the proton in accordance with the constituent quark model, by the quantum mechanics [2], it results finally that:

$$\text{a)}\quad \mu_{pr} = \frac{4}{3}\mu_u^{\bullet} - \frac{1}{3}\mu_d^{\bullet} = e\hbar/2m_p \text{ ; b)}\quad \mu_{ne} = \frac{4}{3}\mu_d^{\bullet} - \frac{1}{3}\mu_u^{\bullet} = -(2/3)e\hbar/2m_p \qquad (3)$$

Hence, within the quark model, one arrives at the prediction for the ratio of the magnetic dipole moments: $\mu_{ne}/\mu_{pr} = g_n/g_p = -2/3$ which is consistent with the experimental value: $(g_n/g_p)_{exp} = -0.68497934$ [2].

The magnetic moment of a baryon B is conventionally written relative to that of the proton and thus expressed as: $\vec{\mu}_B = g_B \cdot \mu_N \vec{s}_B$ where $\mu_N = e\hbar/2m_p$ is the nuclear magneton and s_B is the baryon's spin, 1/2.

The nucleons' magnetic moments: $\mu_p = k_p e\hbar/2m_p = (g_p/2)\mu_N = 2.79\ (e\hbar/2m_p)$, and $\mu_{ne} \approx -2/3\mu_p$ give the mass m_q of the u- and d-quarks by using Equations (1) and (3), resulting that: $m_u = m_p/2.79 = 336$ MeV/c^2; $m_d \approx 340$ MeV/c^2.

The masses of the quarks calculated within the quark model of QCD differ considerably from the current (bare) quark masses that appear in the QCD Lagrangian, because the bare quark masses are provided by the so-called Higgs mechanism but most of the mass of the nucleon, and generally, of hadron, is due to the strong interaction dynamics carried by gluons, the interaction between quarks through gluons producing a plethora of low-energy (nonperturbative) emergent phenomena such as the spontaneous breaking of chiral symmetry which provides a phenomenological explanation for the constituent masses of dynamically-dressed quarks, in the Standard Model of elementary particles.

Another approach based on the Constituent quarks model [3] calculated the magnetic moments of some baryons by the spin splittings resulting from a qq- and $q\bar{q}$-hyperfine interaction that is the same for mesons and baryons in the formula obtained by Andrei Sakharov [4]:

$$M_p^{\square}(p_m) = \sum_i m_i + H_{FB}; \qquad (4)$$

$$H_{FB} = C\sum_{i>j} \frac{\bar{\sigma}_i}{m_i} \cdot \frac{\bar{\sigma}_j}{m_j} \upsilon_{ij};\ \upsilon_{ij} = \left(\lambda_i^c \cdot \lambda_j^c\right)$$

having explicit color and spin exchange dependence and implicit-flavor dependence, by way of effective quark masses, m_i, ($i = 1 \div 3$, for baryons), $\sigma_{i,j}$ being the Pauli spin matrices, $\lambda_{i;j}^c$ being the color charge' Gell-Mann matrices and C being a constant, the quark masses m_i, m_j being obtained by fitting the particle's mass formula with the known experimental value.

The authors obtained excellent theoretic agreement with experiments for the ratio: $(\mu(d)/\mu(s)) = -\mu_P/3\mu_\Lambda = 1.54 \approx 3/2$ and for the magnetic moments of nucleons and of the Λ-baryon but a low fitting for Σ- and Ξ-baryons.

However, a naturalness problem of the Constituent quarks model is to explain how in the β^+-transforming, the proton's charge, given by three quarks, is "transferred" to a released positron; the quarks' model explains that the cause is the transforming of an u-quark: $u^+ \rightarrow d^- + e^- + \nu_e$, but in this case the mass of d-uark would be lower than that of the u-quark—in contradiction to the known masses of the u- and d-quarks.

In a cold genesis theory of particles and fields [5] [6], (CGT), the proton's mass and its nuclear field are given by the superposition of photonic volumes of N^p = (N^c + 2) = 2270 quasielectrons $e^{*\pm}$ with degenerate mass: $m_e^* \approx 0.809 m_e$, coupled in gammonic pairs: γ^* ($e^{*+}e^{*-}$), (N^c representing the number of quasi-electrons of the neutral cluster of the nucleon's impenetrable volume, of radius $r_i \le 0.6$ fm, to which a positron is bound through a linking gammon, γ^*), the quantonic vortices Γ_μ^* of the protonic quasielectrons generating a total dynamic pressure: $P_\mu(r)$ = $(1/2)\rho_\mu(r)\cdot c^2$ at most equal to 1/2 of the nucleon's energy density in the r-point, ($P_\mu(r) \le (1/2)\rho_n(r)\cdot c^2 = 1/2 P_n(r)$), inside a volume with radius: d^n = 2.1 fm, which gives an exponential nuclear potential:

$V_n(r) = -\upsilon_i P_\mu(r)$ of eulerian form, conform to:

$$V_n(r) = \upsilon_i P_\mu(r) = V_{n0} \times \mathrm{e}^{-r/\eta^*};\ \ V_{n0} = -\upsilon_i P_{\mu 0}, \qquad (5)$$

$$(\eta^* = 0.8\ \mathrm{fm};\ \ P_\mu(r) = \frac{1}{2}\rho_n(r)\cdot c^2)$$

the proton's charge being given by degenerate positron, with degenerate magnetic moment of its spin, as consequence to the fact that the electron's centroid (its kernel) enters in a density of quanta (of photons) higher than that of the central part of a free electron, *i.e.*, $\rho_n(r_e^*) \gg \rho_e^0 = 2.224 \times 10^{14}$ kg/m^3, with $\rho_n(r) = \rho_n^0 \cdot \mathrm{e}^{-r/\eta_d}$, ($\eta_d = 0.84 \div 0.87$ fm; $\rho_n^0 = 0.9\rho_e^0 N^c \approx 4.54 \times 10^{17}$ kg/m^3 [4]), according to the equation:

$$\mu_P = k_p \frac{m_e}{m_p}\mu_e^s = k_p \cdot \mu_N \approx k_p \frac{\bar{\rho}_e}{\bar{\rho}_p}\mu_{PB} = k_p \frac{1}{f_d \cdot N^p}\mu_{PB} = \frac{\rho_n^0}{\rho_n(r_e^*)}\mu_N = \frac{e \cdot c \cdot r_\mu^p}{2};$$

$$\rho_n(r_e^*) = \rho_n^0 \cdot e^{-\frac{r_e^*}{\eta_d}};\ \ \eta_d \approx (0.84 \div 0.87)\,\mathrm{fm}; \qquad (6)$$

$$f_d \approx \frac{m_p}{m_e N^p} = \frac{m_e^*}{m_e} \approx 0.809;\ \ k_p = \frac{g_p}{g_e} = 2.79 = e^{\frac{r_e^*}{\eta_d}}$$

Equation (6) indicates that μ_N corresponds to a hypothetical position of the proton's positron in its center, ($r_e^* \approx 0$), while its real magnetic moment μ_P corresponds to a positron's position: $r_e^{*+} \approx 0.893\ \mathrm{fm}$.

The beta-emission at the neutron's transforming is explained in CGT by the existence of an internal negatron, linked to the protonic impenetrable quantum volume by a linking gammon γ^* ($e^{*-}e^{*+}$) = $(1 \div 1.6)m_e$, which is the CGT's correspondent of the SM's gluonic string for the lepton-to quark binding.

Complying with the CF proton soliton model, the neutron results in the theory conforming to a Lenard-Radulescu dynamide model, (Dan Radulescu, 1922 [7]) according to which the neutron is composed by a proton centre and a negatron revolving around it with the speed $v_e^* < c$ at a distance $r_e^* \le a$, at which, according to Equation (6), it has a degenerate μ_e^S-magnetic moment and a S_e^n-spin.

The revolving of the neutronic negatron generates a negative orbital magnetic moment, μ_e^L, the neutron magnetic moment resulting according to equation:

$$\mu_n - \mu_p = (\mu_e^L + \mu_e^S) = (-1.91 - 2.79)\mu_N = -4.7\mu_N;\ \ \mu_e^L = i \cdot S_l = \frac{e \cdot v_e^* \cdot r_e^*}{2} \qquad (7)$$

Because the neutronic negatron orbital rotation take place under the action of the dynamic pressure: $P_d = \frac{1}{2}\rho_\mu\left(r_e^*\right)c^2$ of the Γ_μ^n—quantonic vortex, forming the μ_p—proton magnetic moment and having the $\rho_n(r)$—density inside the quantum volume, it was considered also the equilibrium relation of the dynamic pressures given by these densities acting over the revolved degenerate negatron area: $S' \cong 2\pi a_i^2$, by the approximation:

$\rho_n\left(r_e^*\right) \cong N^p \cdot f_d \cdot \rho_\mu\left(r_e^*\right)$ conform to Equations (5) and (7), in the form:

$$\rho_\mu\left(r_e^*\right)\cdot c^2 = \rho_n\left(r_e^*\right)\cdot v_e^2 \quad (8a)$$

$$\text{if } \eta^* \approx \eta_d \Rightarrow \rho_e^0 c^2 e^{-r^*/\eta^*} \approx \rho_n^0 v_e^2 \cdot e^{-r^*/\eta_d};\ v_e \cong c\cdot e^{-0.05\times r^*}\big/\sqrt{0.9N^c} \quad (8b)$$

For $\eta^* \neq \eta_d$, from Equations (7) and (8) it results that:

$$\frac{r_e^*}{r_N^0}\frac{\mathrm{e}^{-\frac{\eta_d-\eta^*}{\eta_d\eta^*}\cdot r^*}}{\sqrt{0.9N^c}}\mu_N + \mu_N\cdot \mathrm{e}^{r^*/\eta_d} = 4.7\mu_N; \quad (9)$$

$$\left(N^c = 2268;\ \mu_N = \mu_N\left(c; r_N^0 = 0.21\ \text{fm}\right); \eta_d = \left(0.84 \div 0.87\right)\text{fm}; \eta^* = 0.8\ \text{fm}\right)$$

With: $\rho_\mu^0 = \rho_e^0 = 22.24\times10^{13}$ kg/m³; $\rho_n^0 = 4.54\times10^{17}$ kg/m³, η_d = 0.87 fm, from Equations (8), (9) it results that: $r_e^* = 1.322$ fm; $v_e = 0.02c \cong 6.2\times10^6$ m/s; $\mu_e^L \cong -0.13\mu_N$; $\mu_e^S \cong -4.57\mu_N$, so the μ_n-value results by the conclusion that the neutronic negatron has the m_0-centroid of its quantum volume positioned in the surface of the protonic quantum volume (**Figure 1**), while the positronic proton is axially positioned at $r_e^{*+} \approx 0.89$ fm (Equation (6)).

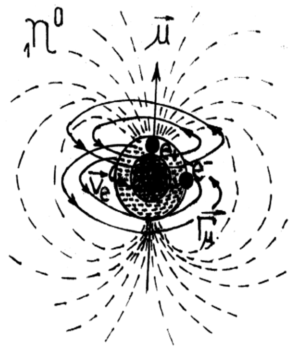

Figure 1. The neutron model in CGT [5].

For η_d = 0.84 fm, it results from Equations (8), (9), that: $r_e^* = 1.28$ fm—value closer to the value: $r_n^0 = 1.25$ fm—used in the formula of the nuclear radius: $r_N = r_n^0 \cdot A^{1/3}$, ($A$—the number of nucleons).

The spin and the revolving frequency of the neutronic negatron around the proton center results by:

$$\nu_e = v_e/2\pi r_e = 0.747\times10^{21}\ \text{Hz};\ \mu = \left(e/m_e\right)\cdot S;\ \Rightarrow S_e^n = \mu_e^S\cdot\left(m_e/e\right) = 0.00124\hbar,$$

($\hbar = h/2\pi$), in concordance with the (quasi) equality between the spin of proton and of neutron, ($S_n \approx S_p = 1/2\hbar$), resulting in the quantum mechanics.

The way in which the real charge of the transformed particle is redistributed on the resulting particles was considered according to the quark theory, considering a fractional electric charge: $q^* = +(2/3)e$, given to quark by a quasielectron and corresponding to a degenerate magnetic moment.

The sum of the current quark charges and the correspondent magnetic moments result as equal to the real charge: 0, e, $2e$, and to the real magnetic moment of the initial particle, because the impulse density of $\Gamma_\mu(e)$—soliton vortex of the real elementary unpaired e-charge of the elementary particle is given as a sum of component vortexes corresponding to the component quark charges, according to the dependence: $e \sim \mu_e(\Gamma_e) \sim \rho_\mu(a) \cdot c^2$, ($r_i < r \le a = 1.41$ fm), specific to CGT:

$$\rho_\mu \cdot c^2 \cdot e = \rho_\mu \cdot c^2 \cdot \left(\frac{2}{3}n - m\right) \cdot e; \quad \mu = \left(n \cdot \mu_u - 4.7\mu_N \cdot m\right)\left[\mu_N\right] \tag{10a}$$

where n; m, are the total number of quarks and respectively, the number of quarks with negative charge, ($-1/3e = +2/3e - e$), μ_u representing the u-quark's magnetic moment.

From Equation (10) and the relation: $\mu_{ne}/\mu_{pr} \approx -2/3$, resulting in the known theory of quarks for the magnetic moments of nucleons, it resulted in CGT that:

$$\mu_u = 8 \times 4.7/15 \approx 2.5\mu_N \approx (8/9)\mu_p; \quad \mu_d = \left(\mu_p - 4.7\mu_N\right) \approx -2.2\mu_N \approx -(7/9)\mu_p \tag{10b}$$

By Equation (10a), it can be explained also the fact that in the β^+disintegration the whole proton's charge is loosed in the form of a positron.

2. The Baryons' Magnetic Moments in CGT; the Correspondence with the Constituent Quark Model

2.1. The Correspondence in the Case of Nucleons

Considering—for preonic quarks (of CGT type), a g-factor (*i.e.* a Lande' type gyromagnetic ratio, taking into account a possible orbital rotation and the quark's structure) of the form: $g^1 = 2$ (g_u; g_d) > 1, (corresponding to quarks with spin s = 1/2), for the magnetic moment μ_q of the u-, d-quarks, considered as equivalent to a spinorial magnetic moment, with the mass of the bound constituent quark: $m_u \approx m_d \approx (1/3)m_p$, ($m_p = m(p_r)$—the proton' mass) and with electric charges: $e_u = 2/3e$ and $e_d = -1/3e$, according to the quark formalism, the proton' magnetic moment results in the form:

$$\begin{aligned} \mu(p_r) &= 2\mu_u + \mu_d = 2g_u\left(e_u\hbar/2m_u\right) + g_d\left(e_d\hbar/2m_d\right) \\ &= 2g_a\left(e_u/e\right)\mu_N + g_b\left(e_d/e\right)\mu_N = k_p\mu_N \end{aligned} \tag{11}$$

($\mu_q = g_g\left(e_q\hbar/2m_q\right)$; $g_a = g_u\left(m_p/m_u\right) \approx 3g_u$; $g_b = g_d\left(m_p/m_d\right) \approx 3g_d$; $k_p = 2.79$).

Multiplying Equation (11) by 2/3 it results:

$$\frac{4}{3}\mu_u + \frac{2}{3}\mu_d = \frac{4}{3}g_a\left(e_u/e\right)\mu_N + \frac{2}{3}g_b\left(e_d/e\right)\mu_N = \frac{8}{9}g_a\mu_N - \frac{2}{9}g_b\mu_N = \frac{2}{3}k_p\mu_N \tag{12}$$

Because we know that:

$\mu(n_e)/\mu(p_r) = -1.91/2.79 = -2.054/3 = -2^*/3 \approx -2/3$, it results that:

$$\mu(n_e) = 2\mu_d + \mu_u = 2g_d\left(e_d\hbar/2m_d\right) + g_u\left(e_u\hbar/2m_u\right)$$
$$= 2g_b\left(e_d/e\right)\mu_N + g_a\left(e_u/e\right)\mu_N = -\left(2^*/3\right)k_p\mu_N \quad (13a)$$

$$\mu(n_e) = 2\mu_d + \mu_u = -2g_b\left(\frac{1}{3}\right)\mu_N + g_a\left(\frac{2}{3}\right)\mu_N = -\left(2^*/3\right)k_p\mu_N \quad (13b)$$

Adding (12) to (13b), it results:

$$\frac{7}{3}\mu_u + \frac{8}{3}\mu_d = \frac{14}{9}g_a\mu_N - \frac{8}{9}g_b\mu_N = \left(\frac{2}{3} - \frac{2^*}{3}\right)k_p\mu_N = -\frac{0.054}{3}k_p\mu_N \approx 0 \quad (14)$$

From (11) and (14) it results: $\mu_d = -(7/8)\mu_u$; $g_b = (14/8)g_a$; $\mu_u = (8/9)\mu_p$; $\mu_d = 8(7/9)\mu_p$; $g_a = (4/3)k_p$; $g_b = (7/3)k_p$; $\Rightarrow g_u \approx (4/9)k_p = 1.24$; $g_d \approx (7/9)k_p = 2.17$.

The small value of the value of g_u compared to k_p corresponds in CGT, through relation (6), to a positioning of the unpaired quasi-electron of the u-quark (giving its charge, conform to CGT) at the distance: $r^0 \approx 0.2$ fm from the nucleon's center, *i.e.* with its centroid attached to the current quark of CGT, therefore, to the degeneracy of its electric charge at the value $e^* = (2/3)e$.

Also, a relative large difference is observed between g_u and g_d, which in CGT can be explained only by the conclusion that the charge $q_d = -(1/3)e$ of the down-quark is given by the charge $(2/3)e$ of an up-quark and the charge of an electron with a degenerate magnetic moment, rotated around the nucleonic core by the etherono-quantonic vortex Γ_μ^* of its magnetic moment, resulting that:

$$\mu_d = \mu_u + \left(\mu_e^s + \mu_e^l\right) \quad (15)$$

the quantities μ_e^s and μ_e^l representing the spinorial and the orbital magnetic moments of the degenerate electron, which explain the charge and magnetic moment of the d-quark, as well as its transformation reaction. Also, the difference between the magnetic moments of the proton and neutron is given by a degenerate electron of a d-quark:

$$\mu(p_r) - \mu(n_e) = 4.7\mu_N = 2\mu_u + \mu_d - \left(2\mu_d + \mu_u\right) = \mu_u - \mu_d; \quad (16)$$

$$\Rightarrow \mu(p_r) - \mu(n_e) = \mu_u - \left[\mu_u + \left(\mu_e^s + \mu_e^l\right)\right] = -\left(\mu_e^s + \mu_e^l\right) \approx \frac{15}{9}\mu_N = 4.65\mu_N = \frac{5}{3}\mu_p$$

The value: 4.65 instead of: 4.7 resulted from the approximation:

$$\mu(n_e)/\mu(p_r) = -2.054/3 = -2^*/3 \approx -2/3.$$

But from Equation (14) it results that:

$$\mu_d = -\frac{7}{8}\mu_u - 0.0538k_p\mu_N;\ \mu_u - \mu_d = \frac{15}{9}\mu_p + 0.019\mu_N = 4.67\mu_N \approx 4.7\mu_N \quad (17)$$

So it would result from CGT and the quarks' formalism, that the nucleon's charge and its magnetic moment are given by three u-quarks with their kerneloids inside the nucleonic core and one or two degenerate electrons rotated around it by the Γ_μ^*—vortex of its magnetic moment.

The "naturalistic" variant, according to CGT, consists in replacing the +2e-charge of the three u-quarks with the charge of 2 polarly disposed positrons, and, respectively, 1 or 2 negatrons rotated around the nucleon's core, explaining the +e -charge of the proton or the zero charge of the neutron.

In this case, the total magnetic moment of the three quarks u:

$3\mu_u = \frac{24}{9}\mu_p = 7.44\mu_N$, corresponds to the sum of the magnetic moments of two polar positrons, each having a magnetic moment:

$\mu_e^+ = 3\mu_u/2 = 3.72\mu_N = \frac{4}{3}\mu_p = \frac{4}{3}k_p\mu_N$, which, according to relation (6) of CGT, corresponds to a polar position at a distance: $r_e^+ = \eta_d \cdot \ln\left[\frac{4}{3}k_p\right] = 1.143$ fm from the nucleonic core, (therefore, inside the proton volume of calibration scalar radius: $r_p^s = 1.41\ \text{fm}$, used in CGT [5]).

It also follows that, for electrons with magnetic moments antiparallel to those of the polar positrons, the nucleonic magnetic moments have the expressions:

$$\mu_p = \left(2\frac{8}{9} - \frac{7}{9}\right)\mu_p = 2\mu_e^+ + \mu_e^- = 3\frac{8}{9}\mu_p - \frac{15}{9}\mu_p;\ \Rightarrow \mu_e^- = -\frac{5}{3}\mu_p \quad (18)$$

$$\text{(a)}\quad \mu_p = 2\mu_e^+ + \mu_e^- = 2\frac{4}{3}\mu_p - \frac{5}{3}\mu_p;\ \text{(b)}\quad \mu_n = -2\frac{5}{3}\mu_p + 2\frac{4}{3}\mu_p = -\frac{2}{3}\mu_p \quad (19)$$

(according to the approximation relation used also by the constituent quark model), with: $\mu_e^- = -(5/3)\mu_p$, corresponding to a polar position at a distance $r_e^- = \eta_d \ln(5/3)g_p = 1.337$ fm from the nucleonic core, conform to Equation (6), if the contribution of the orbital magnetic moment is negligible, (therefore, inside the proton volume of calibration scalar radius: $r_p^s = 1.41\ \text{fm}$).

It is observed that equation (3a) for the proton magnetic moment in the constituent quark model can be obtained from equation (11), by: $(e_u/e) = 2/3$ and $(e_d/e) = -1/3$ in the form:

$$2g_a(e_u/e)\mu_N + g_b(e_d/e)\mu_N = 2\times\frac{2}{3}\left[\frac{3}{2}\mu_u\right] + \frac{1}{3}\left[\frac{3}{1}\mu_d\right] = \mu_p = \frac{4}{3}\mu_u^\bullet - \frac{1}{3}\mu_d^\bullet \quad (20)$$

With the notations: μ_q^* = value calculated in CGT and $\mu_q^\bullet$ = value calculated in the Constituent Quarks Model, (CQM), it results that: $\mu_u^* = \frac{4}{3}\mu_u^\bullet$; ($\mu_u^\bullet = \frac{2}{3}\mu_p$), and:

$$\mu_d^* = -\frac{1}{2}\left(m_u^\bullet/m_d^\bullet\right)\mu_u^\bullet = \frac{7}{3}k_p\left(m_d^\bullet/m_p\right)\mu_d^\bullet;\ \left(\mu_d^\bullet = -\frac{1}{3}\left(m_u^\bullet/m_d^\bullet\right)\mu_p \approx -\frac{1}{3}\mu_p\right) \quad (21)$$

-values consistent with the values: $g_u \approx \frac{4}{9}k_p = 1.24$; $g_d \approx \frac{7}{9}g_p = 2.17$, taking into account the fact that, for the values: $m_u^\bullet$ = 336 MeV/c^2, $m_d^\bullet$ = 340 MeV/c^2, deduced by relation (3) in the Constituent quarks' model, we have:

$m_p/m_u^\bullet \approx k_p = 2.79$, (which gives: $\mu_u^* = \frac{4}{3}\mu_u^\bullet \approx \frac{8}{9}k_p\mu_N$) and the fact that for μ_u^*, μ_d^*, it was used the mass value: m_d = 313 MeV/c^2, (not $m_u^\bullet$ or $m_d^\bullet$).

The values obtained in CGT are therefore explainable in the context in which, unlike relation (3) in CQM, which takes into account the orbital magnetic moments of quarks by the form of the equation, (by the way of deducing it), in the case of relation (11) used in CGT, the contribution of the orbital magnetic moments (*i.e.* of the eventual rotation of the quarks' charge around the particle's center) is "embedded" in the value of the quark's g-factor, g_q.

However, returning to the nucleonic model with the charge given by positrons and negatrons, with the previously deduced values, for the proton we can re-write Equation (19) in the form:

$$\mu_p = 2\mu_e^+ + \mu_e^- = 2\frac{4}{3}\mu_p - \frac{5}{3}\mu_p = 2\frac{8}{9}\mu_p - \frac{7}{9}\mu_p = \frac{4}{3}\cdot\frac{4}{3}\mu_p - \frac{1}{3}\cdot\frac{5+2}{3}\mu_p \quad (22a)$$

$$\Rightarrow \mu_p = \frac{4}{3}\mu_e^+ + \frac{1}{3}\left(\mu_e^- + \mu_n^-\right) = \frac{4}{3}\mu_u^\bullet - \frac{1}{3}\mu_d^\bullet;\ \left(\mu_n^- = 2\left(\mu_e^+ + \mu_e^-\right)\right) \quad (22b)$$

resulting by Equation (22b), the correspondence with the Constituent Quarks Model of the Q.M..

2.2. The Correspondence in the Case of Heavier Baryons

According to the CGT's baryon model, the resulting baryon: Δ^{++} (uuu) = 1232 MeV, for which a value of the magnetic moment was experimentally determined: $\mu(\Delta^{++}) = (4.5 \div 5.6)\mu_N$ [8], has –according to the relations (11) and (19a) of CGT—considering the same factor $k_p = 2.79$ for the proton and a number $n_p = 2$ of polarly disposed electrons, a magnetic moment dependent on the baryon mass, m_B, of the form:

$$\mu_{\Delta^{++}} = \frac{m_p}{m_B}\left[n_p\cdot\mu_e^+ + n_0\cdot\mu_e^-\right] \approx 2\times\left(\frac{4}{3}\right)\frac{m_p}{m_\Delta}\mu_p \approx 5.66\mu_N \quad (23)$$

value close to the upper experimental limit: $(5.6)\mu_N$ [8] and obtained by the fact that in the magnetic moment equation of CGT, we replaced the nucleon mass (specific to the nuclear magneton μ_N) with the mass of baryon Δ^{++}, but considering the same g_u-, g_d -factor of the u-, d-quarks for both, the nucleon and the Δ^{++} -baryon, *i.e.* the same values of μ_e^+ and μ_e^-.

Also, there are theoretically possible variants with $n_p = 1$ or with μ_e^- instead of μ_e^+ and vice-versa, corresponding to antiparticles such as the antiproton or the anti-neutron.

However, this last nucleon model, which is compatible with the quark formalism in CGT in the shown way, is quasi-equivalent to the initial nucleon model obtained in CGT, with a single protonic positron disposed at the distance $r_e^+ = \eta^*\cdot\ln\left(k_p\right) = 0.892\ \text{fm}$ and a degenerate electron rotated by the vortex Γ_μ^* of its magnetic moment, with the same total magnetic moment, given by Eq. (7), in the case of the neutron:

$$\begin{aligned}\mu_e^t &= \left(\mu_e^s + \mu_e^l\right) = -\left[\mu\left(p_r\right) - \mu\left(n_e\right)\right] \\ &\approx -\left(15/9 + 0.02\right)\mu_N \approx -4.7\mu_N = -1.4864\mu_p\end{aligned} \quad (24)$$

with the spinorial magnetic moment: $\mu_e^s = g_e^-\cdot\mu_N \approx 4.57\mu_N$, corresponding to an orbital of radius: $r_e^- = \eta_d\cdot\ln\left(g_e^-\right) = 1.322\ \text{fm}$, (inside the proton volume of calibration scalar radius: $r_p^s = 1.41\ \text{fm}$), for $\eta_d = 0.87$ fm and to $r_e^- = 1.28\ \text{fm}$ for $\eta_d = 0.84$ fm, but having:

$$\mu_e^+ = \mu_p, \text{ (instead of } (4/3)\mu_p).$$

The antiproton and the antineutron correspond to Equation (19a), respectively, to Equation (19b) with changed sign, with polar negatron (s) instead of positron (s), which explains the fact that the magnetic moment of the antiproton is equal in value to that of the proton but with changed sign ($-2.792847344\mu_N$).

The fact that the baryon model of CGT, with a single protonic positron, polarly disposed, is more natural than the previous intermediate model, with two protonic positron polarly disposed, can result from analyzing the possibility of explaining the value of the known magnetic moments of the other baryons containing semi-light quarks, (u, d, s, in the Standard Model).

Since a larger particle mass determines a more intense nuclear vortex field and a greater attraction of the positrons and negatrons that give the baryon charge, but also a similar increase in the repulsive scalar pseudo-charge of the surface of the particle's "impenetrable core", which retains the current quarks inside it, according to the "bag" model of CGT, we can approximate the existence of a dynamic balance of forces in the radial direction corresponding to a quasi-constant value of the radius r_e^+, r_e^-, specific to the position of the electron or positron and implicitly, and to the same factor g_q corresponding to the magnetic moment $\mu_e^\pm$ with which the nucleonic electron contributes to the magnetic moment of the particle.

In this case, an approximation relation for the value of the magnetic moment of baryons heavier than nucleons can be deduced by the CGT's model, in the form:

$$\mu_B = \zeta_q \frac{m_p}{m_B}\left[n_p - n_0 \frac{5^*}{3}\right]\mu_p^+; \ (\ \mu_p^+ = g_p \mu_N; \quad \zeta_q = \pm 1; \quad 5^* = 5.057\ ) \qquad (25)$$

in which $\zeta_q = -1$ corresponds to antiparticle-type structures, in CGT, as in the case of the antiproton.

It results **Table 1** of theoretical magnetic moments of some baryons, deduced with relation (25) and compared to the magnetic moments obtained from experimental data [1].

It is observed that negatively charged particles such as: Σ^-, Ξ^-, Ω^-, although they represent particles in the quark theory, they appear as possible antiparticles, from the point of view of relation (25) of CGT, (by $\zeta_q = -1$), resulting also the existence of some positively charged (+e) flavors of them, (with $\zeta_q = +1$).

It is also observed that the greatest discrepancy results for the particles: Λ^0 (1115) and Ω^- (1672), with Equation (25). In the case of the Λ^0-particle, the success of the constituent quark model to explain its magnetic moment results from the conclusion that this magnetic moment is given only by the strange-quark of this particle [2].

This corresponds, by CGT, to the use of the relation (23) with $\mu_e^+ = (4/3)\mu_p$ and $\mu_e^- = -(5/3)\mu_p$, but with the theoretically possible variant: $n_p = n_0 = 1$, (instead of $n_p = n_0 = 2$), for Λ^0-particle, resulting in this case:

$\mu(\Lambda^0) = (m_p/m_\Lambda)[4/3 - 5/3]\mu_p = -0.783\mu_N$, (close to the experimental value).

Also, for Ω^-, we have similarly:

$\mu(\Omega^-) = -(m_p/m_\Omega)[4/3 - 0]\mu_p = -2.09\mu_N$, (very close to the experimental value).

Table 1. Theoretic values of baryons' magnetic moments, obtained by the CGT's model

Baryon, (**Me**V)	$\frac{m_p}{m_B}$	Number of electrons	μ_B, (μ_N) (theor.)	μ_B, (μ_N) (experim.)	Obs.	Ref. [1], μ_N Quark Modl
p_r/n_e	1	$n_p = 1$;	2.79; −1.91	2.79; −1.91		−1.86
Λ^0 (1115)	0.842	$n_p = 1$; $n_0 = 1$	−1.6	−0.61		imput
Σ^+ (1189)	0.79	$n_p = 1$; $n_0 = 0$	2.2	2.33±0.13		2.68
$\Sigma^{0\dagger}$ (1191)	0.787	$n_p = 1$; $n_0 = 1$	−1.5	−1.61		−1.61
Σ^- (1197)	0.784	$n_p = 2$; $n_0 = 1$	−0.69	−1.16	$\zeta_q = -1$	−1.04
Ξ^0 (1314)	0.71	$n_p = 1$; $n_0 = 1$	−1.356	−1.25		−1.44
Ξ^- (1321)	0.714	$n_p = 2$; $n_0 = 1$	−0.628	−0.65	$\zeta_q = -1$	−0.51
Ω^- (1672)	0.561	$n_p = 1$; $n_0 = 0$	−1.567	−2.024	$\zeta_q = -1$	−1.84
Δ^{++} (1232)	0.762	$n_p = 2$; $n_0 = 0$	4.25	4.52÷5.19		5.58
Δ^+ (1232)	0.762	$n_p = 1$; $n_0 = 0$	2.126	2.3		2.79
Σ^{+*} (1383)	0.679	$n_p = 1$; $n_0 = 0$	1.89	?		
Σ^{0*} (1385)	0.678	$n_p = 1$; $n_0 = 1$	−1.29	?		
Σ^{-*} (1387)	0.067	$n_p = 2$; $n_0 = 1$	−0.595	?	$\zeta_q = -1$	
Ξ^{0*} (1532)	0.613	$n_p = 1$; $n_0 = 1$	−1.163	?		
Ξ^{-*} (1535)	0.612	$n_p = 2$; $n_0 = 1$	−0.54	?	$\zeta_q = -1$	

The value of $(4/3)\mu_p$ instead of μ_p, for the contribution of the polar electron to the magnetic moment of the particle, in the mentioned two particular cases, indicates (according to the CGT's model, Equation (6)), an increase in the radius $r^\pm$ at which the polar electron is positioned, caused by a more pronounced mass-depending increase of the repulsive field of the pseudo-scalar charge of particle's kernel, (of exponential variation), in report to the attractive force of the vortex field, specific (possibly) to a more pronounced state of intrinsic vibration of the current quarks in the particle's impenetrable quantum volume, which corresponds (only in the case of the Ω^--baryon, having $s = 3/2$) to a shorter lifetime, (8.2×10^{-11} s), compared to the average lifetime of the other baryons, ($\sim 2 \times 10^{-10}$ s).

The exception in case of the Σ^0-baryon, whose lifetime is: 7.4×10^{-20} s, can be related to the fact that the orbital electron is attracted by a single polar positron, compared to Σ^-, in which, according to the model, a positron is attracted by two polar negatrons.

It must be mentioned that the chiral quark model suggests that the baryon quark sea is negatively polarized and this modifies the spin structure as given by the naive quark model and agrees with experimental data, but for the magnetic moments, there is significant cancellation between the contributions from this sea spin polarization and the orbital angular momentum, so that effectively the magnetic moments are given by the valence constituent quarks alone, as in the naive quark model [9].

3. The Correspondence of the CGT's Model with Known Phenomena

3.1. The Correspondence of the CGT's Model with the Beta Disintegration

According to the Standard Model, the beta$^-$ transformation of a neutron into a proton involves the emission of a W^- boson, the force-carrying particle of the weak interaction, which then quickly decays into an electron and an electron antineutrino.

According to the CGT's model, the electron (s) is/are incorporated into the particle volume and is/are bound to its core by "gluol (s)" formed from at least one linking gammon resulting as a pair of degenerate electrons with opposite charges: γ^* $(e^{-*}e^{+*}) \approx (1 \div 1.6)m_e$.

In this case, the beta (-)-disintegration is explained in CGT by the dynamid model of nucleon, by the conclusion that the reaction of neutron transforming and of proton's transforming [10]:

$$^{0}\mathrm{n}_{\mathrm{e}} \to {}^{1}\mathrm{p}_{\mathrm{r}} + \mathrm{e}^- + \bar{\nu}_{\mathrm{e}} + Q_k\left(780\ \mathrm{keV}\right); \tag{26a}$$

$$^{+}\mathrm{p}_{\mathrm{r}} \to {}^{0}\mathrm{n}_{\mathrm{e}} + \mathrm{e}^+ + \nu_{\mathrm{e}} + Q_k \tag{26b}$$

results phenomenologically in the form [5]:

$$\mathrm{M}_{\mathrm{p}}^{*+} + \mathrm{w}^-\left(\gamma^*;\mathrm{e}^-\right) \to \mathrm{M}_{\mathrm{p}}^{+} + \mathrm{e}^- + \bar{\nu}_{\mathrm{e}} + \epsilon_\sigma\left(889\ \mathrm{keV}\right), \tag{27a}$$

$$\mathrm{M}_{\mathrm{p}}^{*+}\left(m_p^*;\gamma^*;\mathrm{e}^+\right) \to \mathrm{M}_{\mathrm{n}}^{*0} + \mathrm{e}^+ + \nu_{\mathrm{e}} + \epsilon_{\sigma'};\left(\gamma^* \to \nu_{\mathrm{e}}\right) \tag{27b}$$

as given by a w^-—weson, formed by an electron and a linking gammon, γ^*, weson which is split by the nucleon's intrinsic vibrations into an electron (accelerated by the transforming energy of the γ^*—gammon and the vortical field of the particle's magnetic moment, Γ_μ) and an electronic (anti)neutrino, ν_e, ($\bar{\nu}_e$), formed as paired electronic centroids with opposite chiralities, remained after the losing of the energy ϵ_σ of the photonic shells of the γ^*-gammon's degenerate electrons.

For example, it is known that in the beta decay of ^{210}Bi, an electron with 0.40 MeV energy is released and the total decay energy is 1.16 MeV, the remaining energy: $\Delta\epsilon = 0.76\ \mathrm{MeV}$ being considered as the antineutrino's energy. But because the electron neutrino has a maximal rest mass of ~10^{-4} m_e (Bergkvist, 1972 [11]) and because in CGT the particle's mass is not really increased with its speed, the value $\Delta\epsilon = 0.76\ \mathrm{MeV}$ represents the energy ϵ_σ released at the γ^*-gammon's transforming into electronic (anti)neutrino by the losing of the photonic shells of its quasi-electrons.

Another example is the electron capture, sometimes included as a type of beta decay [3] process in which an inner atomic electron is captured by a proton in the nucleus, transforming it into a neutron, and in which an electron neutrino is released, as in the reaction [12]:

$$_{36}\mathrm{Kr}^{81} + \mathrm{e}^- \to {}_{35}\mathrm{Br}^{81} + \nu_\mathrm{e} \quad (28)$$

Contrary to the opinion that an (e^--e^+)-annihilation not occurs in this process, according to CGT the captured negatron and a protonic positron will form in the protonic volume an un-stable gammonic pair, the emitted electron antineutrino resulting as pair of electronic centroids with opposed chiralities by the losing of the energy ϵ_σ of the photonic shells of the γ-gammon's degenerate electrons.

But CGT not exclude the variant without neutrino emission –corresponding to a simple incorporation of the captured electron in the surface of a nuclear proton.

According to the previous explanations, the differences in mass between: Σ^+, Σ^0 and Σ^- and between: Ξ^0 (1314.86) and Ξ^- (1321.7) are explained in CGT by the difference in the total number of incorporated electrons, bound to the particle's kernel by at least a linking gammon γ^*.

This conclusion is also conformed to other sets of particles, (doublets, triplets or quadruplets): Σ_c^{++} (2453.97), ($n_p = 2$); Σ_c^+ (2452.9), ($n_p = 1$); Σ_c^0 (2453.75), ($n_p = 1$, $n_0 = 1$), or: Σ_b^+ (5810.56), ($n_p = 1$); Σ_b^- (5815.64), ($n_p = 2$, $n_0 = 1$), or: Ξ_c^0 (2467.9) şi Ξ_c^- (2470.9), or: Ξ_c^0 (5791.9) and Ξ_c^- (5797.0), or: Σ^{*+} (1382.8), Σ^{*0} (1383.7), Σ^{*-} (1387.2), or: Σ_c^{*++} (2518.41), Σ_c^{*+} (2517.5), Σ_c^{*0} (2518.48), or: Σ_b^+ (5830.3), Σ_b^- (5834.7), or: Ξ^* (1531.8) and Ξ^{*-} (1535.0), or: Ξ_c^{*0} (2645.5) and Ξ_c^{*-} (2646.4), or: Ξ_b^{*0} (5952.3) and Ξ_b^{*-} (5955.3).

3.2. The Correspondence of the CGT's Model with the P-Parity Violation Experiment

As it is known, theoretical physicists Tsung-Dao Lee and Chen-Ning Yang concluded that in the case of the weak interaction, the experimental data neither confirmed nor refuted P-conservation [13].

Wu proposed an experiment with Co-60 nuclei polarized in a magnetic field, by the reason that if the emitted electron from decay products of cobalt-60 were being emitted preferentially either along or against the cobalt spin axis direction, this would create a difference analogous to the mark. A difference in emission probability would signify a violation of parity symmetry, as stated by Wu *et al.* [14].

During this decay, one of the neutrons in the cobalt-60 nucleus decays to a proton by emitting an electron (e^-) and an electron antineutrino (ν_e), the resulting excited nickel nucleus decaying to its ground state by emitting two gamma rays (γ) in quick succession, the overall nuclear reaction being:

$$^{60}\mathrm{Co}_{27} \to {}^{60\mathrm{m}}\mathrm{Ni}_{28} + \mathrm{e}^-_{0.31\,\mathrm{MeV}} + \bar{\nu}_\mathrm{e};\quad {}^{60\mathrm{m}}\mathrm{Ni}_{28} \to {}^{60}\mathrm{Ni}_{28} + \gamma_{1.17\,\mathrm{MeV}} + \gamma_{1.33\,\mathrm{MeV}} \quad (29)$$

with: $\Delta M = (M_{Co} - M_{Ni}) \approx 2.85\ \mathrm{MeV/c^2}$; $^{60m}Ni_{28}$—isomeric (meta-stable) state.

The Wu experiment reported a large beta-emission asymmetry between the two directions of nuclear spin polarization, showing that parity was not conserved, because the emission of beta particles is more favored in the direction opposite to that of the nuclear spin [14].

By the CGT's dynamide model of neutron, this phenomenon can be explained by the conclusion that the protonic positron is positioned preferentially in the south pole of the proton's volume, so the neutronic electron, which initially has a median position between two protonic centers, will be emitted (by the released energy ϵ_σ resulting from a linking "gammon" transforming into (anti)neutrino) preferentially in the direction opposite to that of the nuclear spin, because the attractive electrostatic force of the protonic positron.

Also, it is observed that the mass difference between the nuclei of Co and Ni: $\Delta M = (M_{Co} - M_{Ni}) \approx 2.85$ MeV/c^2, it is retrieved not only as rest mass-energy of the released particles (e^-, $\bar{\nu}_e$, γ) but, partially, and in their kinetic energy, in concordance to the CGT's model of beta-disintegration by ($\gamma^* \to \nu_e$) transforming, (Equation (27b)).

3.3. The Correspondence of the CGT's Model with the Pygmy Resonance

It is known that, apart from the giant nuclear resonance, whose large cross sections were obtained with high energy photons, of about 15 MeV, and now are understood as due to a collective nuclear response to the electric dipole (E1)-field of the photon, it was also observed the pygmy dipole resonance (PDR), which is a dipole oscillation excitation of neutron-rich atomic nuclei. Its name derives from its significantly lower intensity compared to the giant dipole resonance (GDR), in which the protons oscillate against the neutrons in the nucleus. It is also sometimes referred to as soft dipole resonance (SDR). The resonance is found primarily in nuclei close to the neutron threshold [15].

It is often interpreted qualitatively as the oscillation of a neutron "skin" against a residual nucleus consisting of an equal number of protons and neutrons. The restoring force for this oscillation is the "nuclear force," considered in S.M. a residual interaction of the strong interaction. The electric charge of the nucleus mediates the coupling with external electromagnetic fields—photon scattering is used to study these resonances. The pygmy resonance is typically found in an energy range of 4 - 10 MeV. It covers about 1% of the energy-weighted sum rule (EWSR) for electric dipole strength, with almost the entire remainder being occupied by the electric dipole giant resonance, hence the name. Evidence of the pygmy resonance below the neutron threshold has been found in doubly even nuclei with a neutron number of 82. This can be studied, for example, in photon scattering experiments. Using Coulomb excitation, a resonance-like structure was found in neutron-rich radioactive Sn isotopes above the threshold at GSI. The structure and nature of the PDR are completely unknown, such as the question of its isospin character. Possible collective models of the PDR include oscillations of a neutron skin against the residual nucleus or excitation of alpha clusters in the nucleus. The Pygmy resonance, interpreted as the oscillation of a thin neutron shell, also serves as a model for the behavior of asymmetric neutron-rich nuclear matter, such as in neutron stars or heavy nuclei [15].

In CGT, we can suppose by the dynamide neutron model, that the pygmy dipole resonance is due to the alternative migration inside the nucleus of some neutronic electrons, from excedentary neutrons to some protons, which gives the apparence of nucleons' migration.

According to this explanation, pygmy dipole resonance can be induced by a periodically oscillant electric field, of very high intensity, (close to the Schwinger limit: 10^{18} V/m [16]), obtainable by a high power source of high-frequency current, (of microwaves).

According to the Schiff theorem [17], the atomic electrons completely screen the atomic nucleus from an external static electric field. However, this is not the case if the field is time dependent. Electronic orbitals in atoms either shield the nucleus from an oscillating electric field when the frequency of the field is off the atomic resonances or enhance this field when its frequency approaches an atomic transition energy. In the resonance case, it was demonstrated that the microwave-frequency electric field may be enhanced up to six orders in magnitude due to rovibrational states [18]. It was considered as possible applications of these results also nuclear electric dipole moment measurements and stimulation of nuclear reactions by laser light [18].

4. Conclusions

So, the relative correspondence between the values of the baryons' magnetic moments obtained by a vortical pre-quantum model of baryon of CGT (in which the baryon's electric charge is given by embedded electron (s) with degenerate magnetic moment) and the Constituent quark model, (in which the baryon's electric charge and its magnetic moment are given by the fractional charge and the total magnetic moment of three constituent quarks having spinorial and orbital magnetic moments), is explained in concordance with the experimental observations regarding the beta-decay process. For the known baryonic decuplet, resulting by (semi)light quarks, satisfactory values of magnetic moments were obtained.

The CGT's model solve the classical problem of the nucleon spin and magnetic moment value, problem which determined the abandonment of the classical nucleon model presuming incorporated nucleonic electron(s).

The continuous energy spectrum of β-radiation observed at the neutron transforming, corresponding to a v_e-speed of β-electron of value: 0.7 ÷ 0.92c, is explained through the acceleration given to β-electron by the Γ_{μ}^{p}-vortex of the remained proton after β-disintegration.

The success of the semi-formal model of constituent quarks is therefore explained by its correspondence with a more natural model: that of CGT, which naturally explains how the proton charge is lost in the form of a positron—in the

β^+ decay and how an electron with a full electric charge is emitted in the β^- decay.

Wu's experiment of P-parity violation can also be explained phenomenologically by the CGT's model of nucleon.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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